“How long will it take and how much is it going to cost?”

PM Challenge 2009

Anita Thomas, PMP

Richard Greathouse

Contents

- Purpose
- Joint Confidence Level (JCL) Budget Requirements
- Program/Project (P/P) And Source Review Board (SRB) Roles And Responsibilities For JCL
- Key Decision Point (KDP) Review Process
- JCL Development Process
- Challenges

Purpose

- Discuss how Programs and Projects will work together with the SRB Independent Review process to develop tools and methodologies to deliver JCL assessments to the Governing Program Management Council (PMC) at KDP B and C as required by NPD 1000.5

NPD 1000.5

- (a) Programs are to be baselined or rebaselined and budgeted at a confidence level of 70% or the level approved by the decision authority of the responsible Agency-level management council. For a 70% confidence level, this is the point on the joint cost and schedule probability distribution where there is a 70% probability that the project will be completed at or lower than the estimated amount and at or before the projected schedule. The basis for a confidence level less than 70% is to be formally documented.

- (b) Projects are to be baselined or rebaselined and budgeted at a confidence level consistent with the program's confidence level.

Joint Confidence Level (JCL) Assessments

IPAO and CxP are pioneering the process to develop tools and methodologies to produce a Joint (cost/schedule) Confidence Level (JCL assessment for KDP B and C)

In the future all programs and projects will be required to deliver these products to their Governing PMC

Partnering Approach

- The end game is to present a Program/ project (P/p) JCL assessment that is owned by the project and assessed by the SRB
- Based on common methodologies and tools
- Timelines and methodologies will be planned together at the beginning of the review

P/p and SRB Roles and Responsibilities

- Both P/p and SRB will develop probabilistic cost and schedule estimates
- Both P/p and SRB will perform cost and schedule risk analysis
- Both P/p and SRB will develop JCL Assessment
- SRB will evaluate the P/p products
- P/p and SRB results will be shown at the governing PMC

Program/project Products

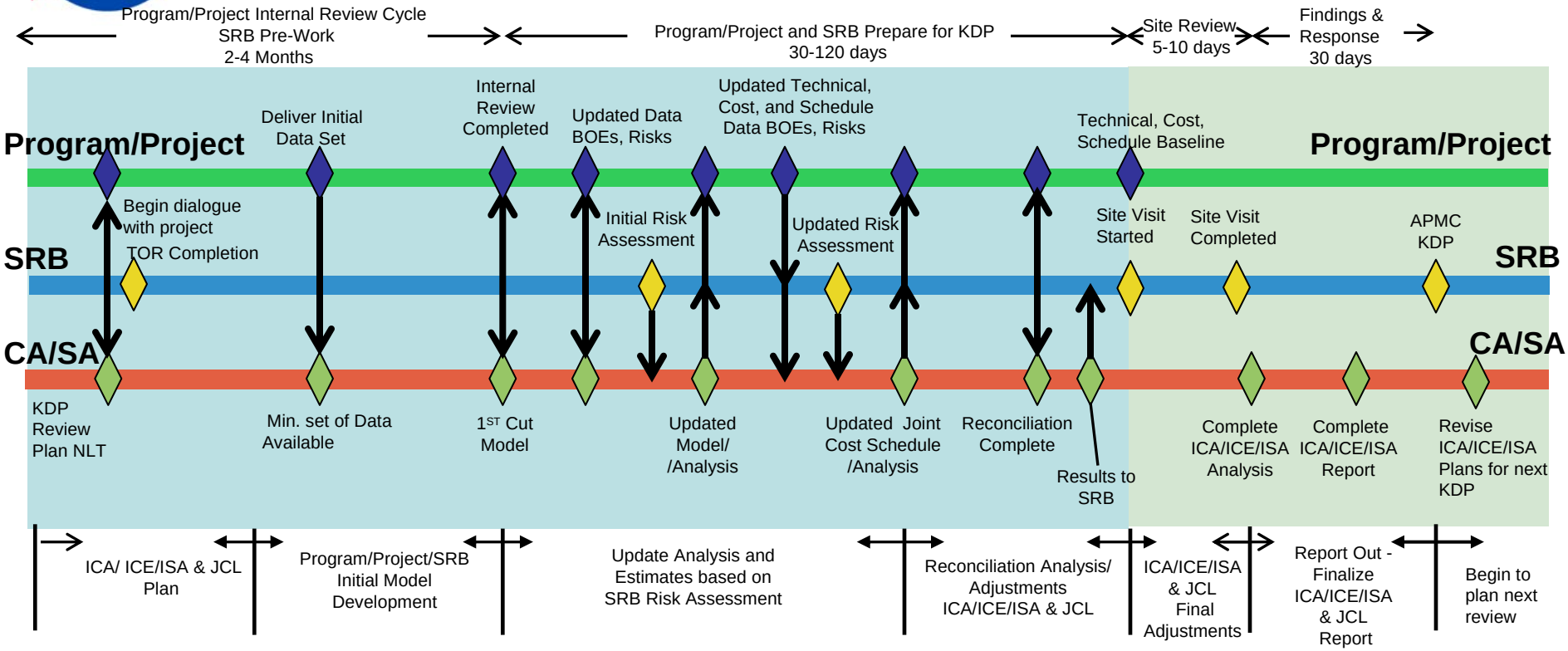
- Probabilistic Cost Estimate
- Integrated Master Schedule Tied To Cost Estimate
- Schedule Risk Analysis
- JCL Assessment

SRB KDP Products

- Independent (parametric) Cost Estimates (for KDP B & C)
- Independent P/p Schedule Assessment/Risk Analysis
- Independent JCL Assessment
- Above is yardstick to enable the SRB to evaluate P/p products:
  - Cost Estimate
  - Schedule/Schedule Risk Analysis
  - JCL Assessment

KDP Review Process

Program/Project/SRB Cost/Schedule & JCL Development/Analysis Process *



ICA/ICE/ISA & JCL Plan
- Tools
- Approach
- Analysis method
- Timeline
- Unique Needs
- Integration Plan

TOR Data Set
- WBS dictionary
- Master Equipment List
- CADRe Data
- Schedule products
- BOEs
- Etc.

ICA/ICE/ISA & JCL Models
- Facts
- Assumptions
- Context

ICA/ICE/ISA & JCL Reconciliation
- Action Items for Estimate update
- Document the difference between project& SRB est.
- Agreement between the project and ICA Analyst about the Facts

ICA/ICE/ISA & JCL Report
- Purpose of the Estimate
- Methodology Assumption
- Comparison Analysis
- Cost Phasing
- JCL

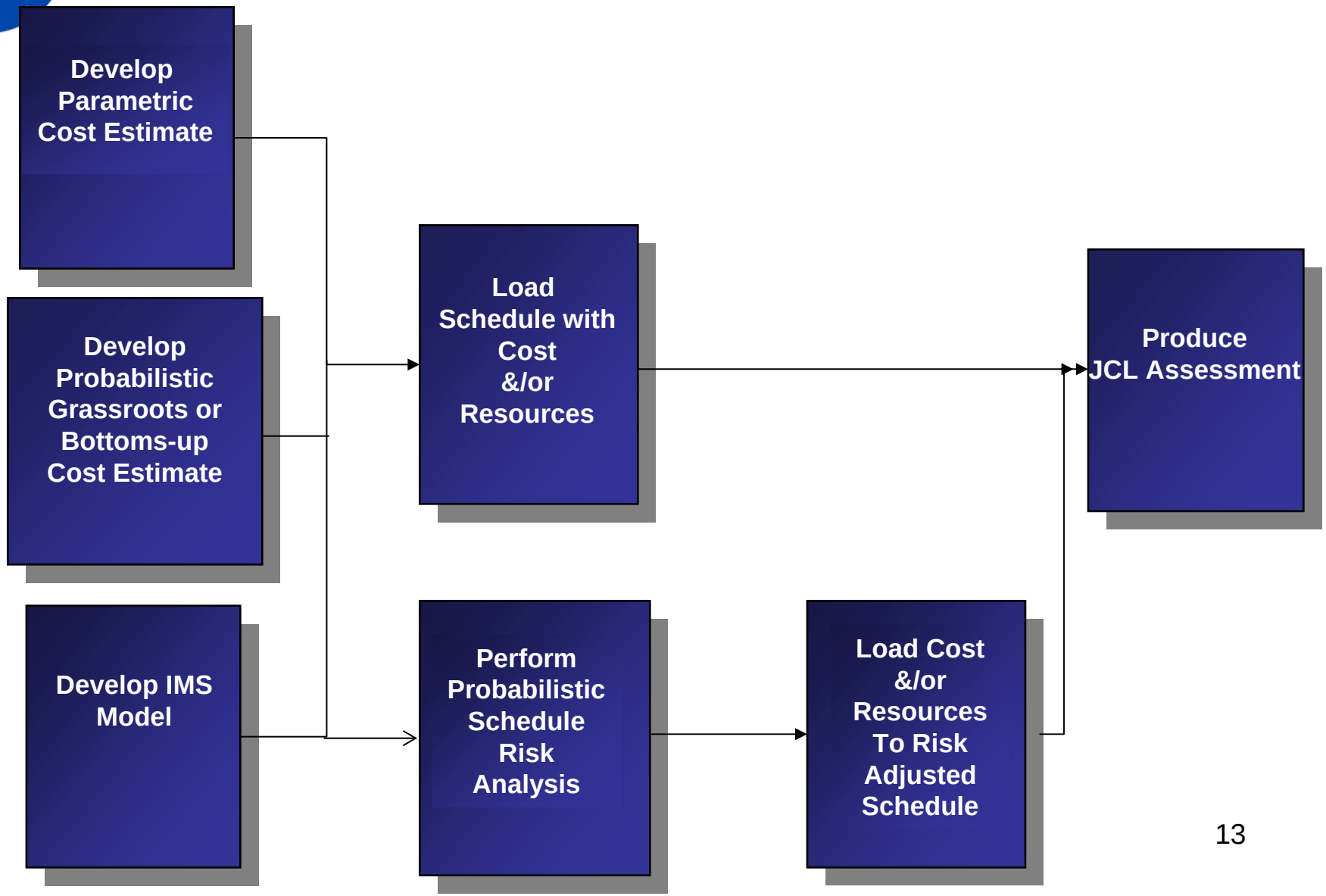
Revise Plans
- Lessons Learned
- Update for next review

*Specific times will be flexible based on individual P/p being reviewed
ICE developed at KDP B, KDP C or as requested

- **RM coordinates all activities**
- **SRB involves all the board members**
- **CA/SA -Cost Analyst & Schedule Analysts**

Cost/Schedule and JCL Development Process

JCL Process


Develop Parametric Cost Estimate
Develop Probabilistic Grassroots or Bottoms-up Cost Estimate
Develop IMS Model
Load Schedule with Cost &/or Resources
Perform Probabilistic Schedule Risk Analysis
Load Cost &/or Resources To Risk Adjusted Schedule
Produce JCL Assessment

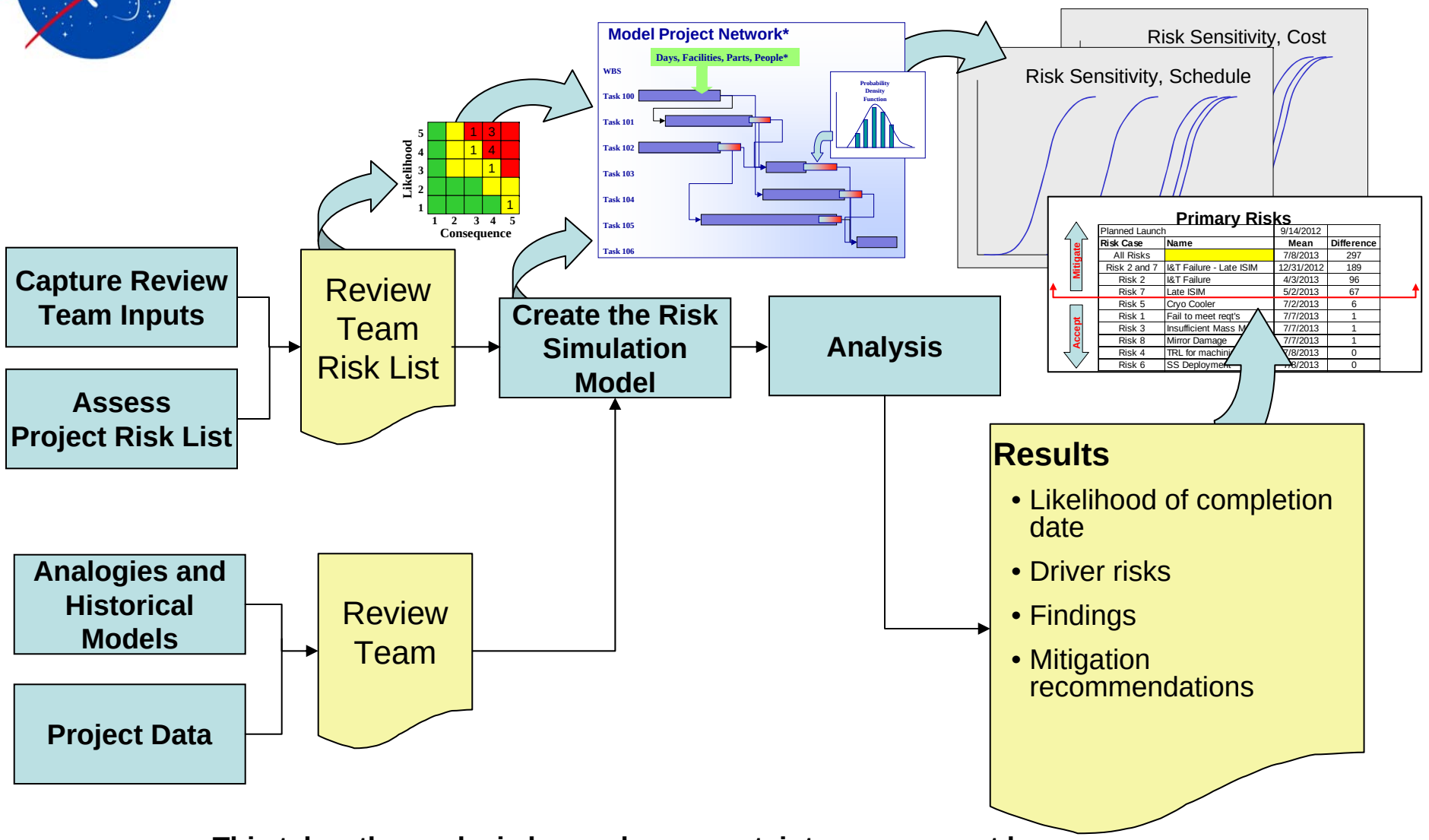
KDP Products Development Process

- Probabilistic Cost Estimate
  - Parametric
  - Bottoms-up
  - Analogy
- Schedule Estimate
  - Integrated Master Schedule/Model
- Schedule Risk Analysis
- JCL Assessment

Cost and the JCL

- JCL requires probabilistic cost estimate
- Parametric cost estimates use CER based models
- Bottoms-up or grass roots estimates are developed from program/project specific Basis of Estimates (BOE)

Schedule Risk Assessment Process



This takes the analysis beyond an uncertainty assessment by incorporating the impact of discrete P/p risks into the model

Basis of Estimate (BOE)

Accurate results are dependent on the information, assumptions, risks and quality of the information used in the development of the product

A BOE is documentation of all the information that was used to produce a cost estimate or schedule that a person of reasonable skill can use to duplicate the results

All cost and schedule product deliverables must include a well documented BOE

BOE Best Practices

- Be factually complete, but be concise.
- Be able to support your facts and findings.
- Identify estimating team members and their roles.
- Describe the tools, techniques, estimating methodology, and data used to develop the cost estimate.
- Identify other projects that were referenced or benchmarked during estimate preparation.
- Develop the cost (and schedule) estimate and the BOE concurrently.
- The BOE establishes the context of the estimate, and supports review and validation.

From AACE International Recommended Practice No. 34R-05

Garbage In/Garbage Out

A well prepared basis of estimate will:

- Document the overall project scope.
- Communicate the estimator's knowledge of the project by demonstrating an understanding of scope as it relates to cost and schedule.
- Alert the project team to potential cost risks and opportunities.
- Provide a record of key communications made during estimate preparation.
- Provide a record of all documents used to prepare the estimate.
- Act as a source of support during dispute resolutions.
- Establish the initial baseline for scope, quantities and cost for use in cost trending throughout the project.
- Provide the historical relationships between estimates throughout the project lifecycle.
- Facilitate the review and validation of the cost estimate.

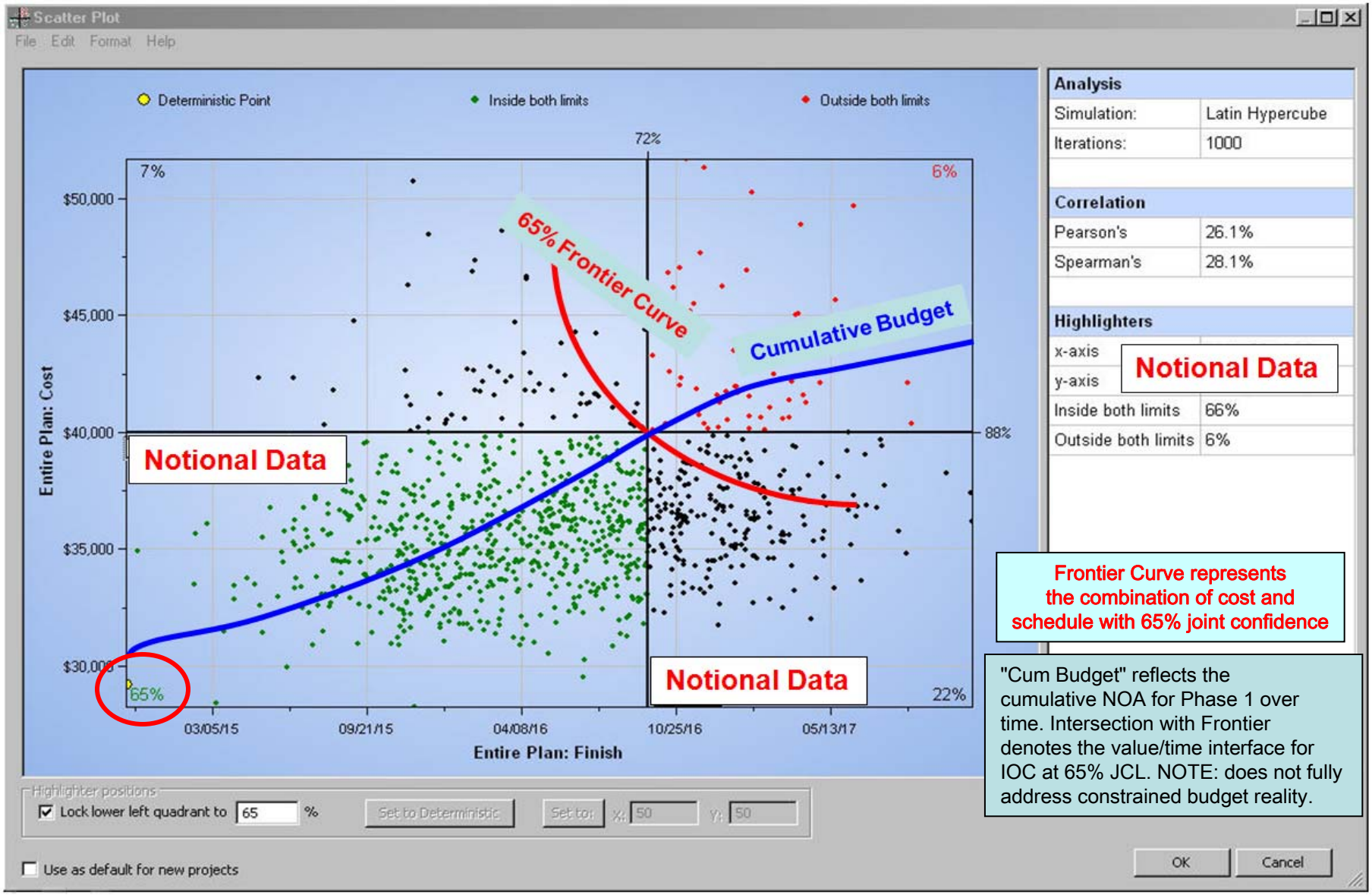
From AACE International Recommended Practice No. 34R-05

Examples of SRB Team Inputs to ICE/SRA

- Technical/schedule baseline assessment for inputs, including technical inputs, such as number of parts, materials, construction method, precision, yield for complexity generator inputs, etc.
- Schedule assessment, e.g., compared to average for the subsystem, is the schedule too long, about right, short or compressed
- Complexity – more components than average, sensitive alignments or assembly
- Severity of requirements for lifetime or operating environment than other systems flown on similar missions
- Technology Readiness Level (TRL) and design heritage to determine development cost impacts, including maturity of components
- Cost and schedule risk parameters in determining range of input values for Monte Carlo Risk Model and determine correlation between Work Breakdown Structure (WBS) elements

Example JCL Product

PertMaster - Frontier Curve - Example



Challenges

Cost/Schedule Methodologies & Challenges to the JCL

- Cost models use CER – historic, analogous data
- Schedule model can use historic data for a ball park estimate of uncertainty but also requires a close examination of the quality of the project schedule and must incorporate specific project risks
- Resource loaded schedule – what resource assumptions to use, cost models "book keep" information differently, direct vs. indirect costs, time dependent vs. independent costs
- Integrated ICE/SRA – use different WBS levels, some uncertainty, complexity and schedule assumptions in a CER may be duplicated in a schedule risk model

Plan – Communicate - Coordinate

- Organization Contributions to a Successful JCL
- Resource Management, Cost Estimating and Planning/Scheduling Functions are jointly responsible for the JCL
- Plan early, meet often, constantly review the progress each group is making
- Ask IPAO and PA&E for help

Program/Project/SRB Common Tools

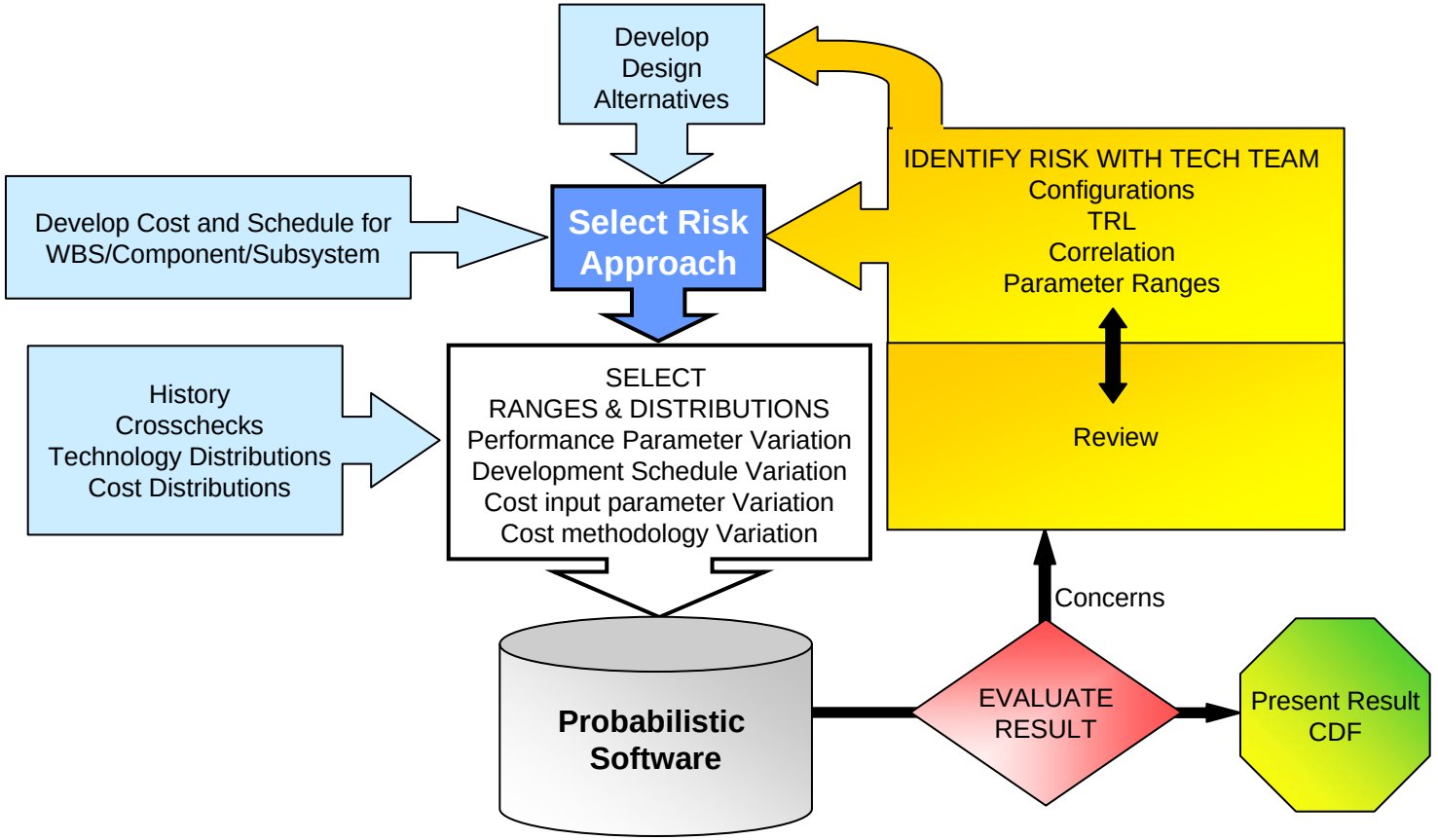
- CER based cost estimating
  - NAFCOM
  - ACEIT
  - SEER
  - PRICE
- Schedule project planning
  - MS Project
  - Primavera
- Probabilistic schedule risk analysis
  - @Risk
  - Risk+
- Probabilistic joint cost/schedule
  - Pertmaster
  - @Risk

Conclusions

- The primary goal of the SRB independent review process is to foster P/p success
- Improving upfront program/project planning through better cost estimates and schedules will increase the likelihood of successfully reaching the technical requirements within cost and schedule guidelines
- The JCL requirement will help foster more cooperation between the SRB and the P/p being reviewed at each KDP
- We are here to help

Backup

Risk Assessment Process



Risk Model

- Simulation Model Development
  - Establish an integrated top level program schedule with that matches key program/project assumptions and dates
  - Match project Critical Path
  - Include reserve identified in the source documents
- Risk Sources – latest available
  - Program/project risk list
  - SRB technical team risk identification
- Select probability distributions (risk will occur 10-25% of the time, etc.)
- Estimate potential impacts (x% rework, order new parts – long lead procurement, etc.)

Discrete Risk Cost Analyses

- Discrete risk cost estimates are a set of risks and mitigation plans that the SRB chooses to pursue and the estimating team costs
- Events that have a certain probability of occurring and will incur a certain additional cost if they do occur and zero additional cost if they don't
- Occur or don't occur, no possibility of partial occurrence, e.g., a solid rocket motor may or may not explode on the test stand
- WBS items that only come into existence if the event occurs – If the motor explodes on the stand, a WBS item appears called "Build New Test Stand."

Schedule Risk

(Review Team Input)

1. Did the project schedule assessment identify risk areas?
2. Are there activities that are not in the current schedule that would reduce project risk if they were added? What are they?
3. What is the probability that an identified risk will occur?
4. If it occurs, what are the possible schedule impacts?
   a) Rework - additional iterations of scheduled work
   b) Additional work not yet in schedule
5. What is the impact of each risk on its own; what is the impact of different risk combinations and cumulative risk when they are all considered?
6. Can some risk be eliminated if another risk event actually happens?
7. How long could these activities take? – give a low-medium-high duration range
8. What is the relationship to current activities? (Predecessor/successor or parallel activities)
9. Will this work delay current activities or can they be done in parallel?
10. What is the potential impact of all of the above on project resources?

WBS Element Uncertainty